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Title of the invention: SHIELDING COMPOSITE FOR ELECTRIC INDUCTION  
RECORDING MATERIALS

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#### CLAIM:

A shielding composite for electric induction recording materials consisting of at least linear saturated copolymerized polyester and silica particles (the ratio of silica particles to linear saturated copolymerized polyesters being from one through to 30 percent by weight), as a composite to form a layer lying between paper base materials and a metal deposited layer and as a composite to form a layer adjacent to the metal deposited layer.

#### DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a shielding composite for electric induction recording materials that lies between paper base materials and a metal deposited layer in recording materials used for facsimiles that visually record characters, signals, diagrams and others using electric signals, consisting of at least linear saturated copolymerized polyesters and silica particles that are useful as a composite that forms a layer adjacent to the metal deposited layer.

The purpose of the present invention relates to providing a shielding composite for electric induction recording materials, which metal deposited layer is white-like in color, and produced fumes and odors accompanied by burning or evaporation of deposited metal at the time of recording with power turned on are far less than conventional recording material composites.

While the electric induction recording sheet using metallic deposition is well known (Japanese Patent Publication No. SHO32-10,438), said recording sheets are those deposited with metal on the surface of paper base materials (colored or white base paper), and in said recording sheets an image is formed by exposing the base materials to the surface with deposition metal removed by burning or evaporation using currents flowing through entry electrodes at the time of recording, whereas ordinarily the color of

the deposited surface of said recording sheets does not become white but becomes gray or metallic color with a strong glossiness, and thereby the contrast of the image is low when viewed with the naked eyes.

Though recording sheets having a colored layer provided on white paper base materials deposited with metal thereon are also well known, various problems such as the generation of fumes and odors and the like caused by burning or evaporation of deposited metal may occur at the time of recording depending on the composites that form the colored layer. Also, the selection of composites of said layer is very important to make the deposited surface white-like in color.

In view of the above fact, the present invention has found that the occurrence of fumes and odors accompanied by burning or evaporation of deposited metal can be extremely decreased by providing a layer that lies between paper base materials and a metal deposited layer and contacts the deposited layer, and by using at least linear saturated copolymerized polyesters and silica particles for the composites of said layer.

The table 1 shows the comparison of the degree of the occurrence of fumes and odors at the time of recording on recording sheets that use various types of resin and linear saturated copolymerized polyesters as bonding agents and as a composite of the layer that lies between paper base materials and a metal deposited layer and contacts the deposition layer.

Table 1						
Comparison items						Present invention
Linear saturated copolymerized polyester	Bonding resin	Styrenated alkyd resin	Acrylic ester resin	Vinyl chloride-vinyl acetate copolymer	Polyvinyl butyryl	Unsaturated polyester
Degree of occurrence of fumes and odors at time of recording	×	△	△	△	△	○

The following are linear saturated copolymerized polyesters that are available for use for the present invention:

- Copolyester of ethylene terephthalate and ethylene isophthalate (mixture ratio: from 80/20 to 30/70)
- Copolyester of ethylene terephthalate and 2,2-bis

[4-( $\beta$  hydroxy ethoxy) phdenyl] propane terephthalate (mixture ratio: from 80/20 to 20/80)

- c) Copolyester of bis ( $\beta$  hydroxy ethoxy) terephthalate and 2,2 bis [4-( $\beta$  hydroxy ethoxy) phenyl] propane
- d) Copolyester of diphenol terephthalate and diphenyl isophthalate and others.

These kinds of resin are copolyesters that do not crystallize easily and have a good solubility. Also, though only a linear saturated copolymerized polyester group of polymers can be used as a bonding agent, those polymers that have compatibility with a linear saturated copolymerized polyester group of polymers, for example, resin such as nitrocellulose and others or a small quantity of compatible polymers such as xylene resin and the like can be mixed if required.

It has already been well known that in order to color metal deposited surfaces white-like, there are such means as a method to oxidize said surfaces with weak acid, or an embossing chemical process which provides small unevenness on the surface, or a method to color a metal deposited surface white-like by radiation heat that resin receives at the time of the deposition of metal through use of low softening point resin that lies between paper base materials and a metal deposited layer and is used as a composite of the layer contacting the deposited layer.

The present invention is used to color the metal deposited surface white-like by using linear saturated copolymerized polyesters, the resin that causes extremely small fumes and odors at the time of recording, together with silica particles as composites of the layer lying between paper base materials and a metal deposited layer and contacting the deposited layer wherein the surface of said layer is turned into the surface with subtle unevenness that removes the luster of the metal by depositing the metal in accordance with the degree of the unevenness of the surface of said layer at the time of the vacuum deposition of metal.

The ratio of addition of silica particles is important at said composition, and especially it considerably affects white-like colored of deposition surfaces and the imaging property of recorded images.

In the case that the ratio of addition of silica particles to linear saturated copolymerized polyesters is not more than 1% by weight, it is difficult to color the metal deposited surface white-like, since it is difficult to burn deposited metal at the time of recording and thereby a clear image is not formed. Though its cause is not clear, it is probable that when the ratio of addition of silica particles is small, the affinity of linear saturated copolymerized polyesters to deposited metal acts strongly to make it difficult to burn the metal. Similarly, in the case that the ratio of addition of silica particles is

30% or more by weight, the deposited surface is gray and cannot become white-like. Therefore, it is necessary that the ratio of addition of silica particles to linear saturated polyesters falls within the range of 1% through 30% (by weight of solid portion).

Said composite can be used as a colored layer or protection layer lying between paper base materials and metal deposited layer, and generally it is preferable that the colored layer is provided on white paper base materials, and the protection layer on either colored paper base materials or said colored layers.

Especially in the case that said composite is used on said colored layer as a protection layer, a lot of advantages are observed in addition to the above-mentioned excellent features in such a way that colored particles of the colored layer are prevented from scattering that may occur together with burning or evaporation of metal at the time of recording, and also recording sheets can withstand physical damage (scratches and friction) when handled, and furthermore a fingerprint is not easily marked.

Since silica particles provide subtle uneven surfaces, and at the same time said particles have less shielding compared with other particles, coloring strength does not decrease, and thereby the decrease in the density of recorded images that are formed by electric conduction can be avoided. Also, since said particles improves blocking properties, the working process control of paper coating is made easy, which is one of the great advantages. Commercially available silica particles and alkyl silica, for example, methyl silica that is silanol radicals chemically substituted by alkyl radicals, is used as said particles.

While deposition metal is such metal as aluminum, zinc and others, said metal is vacuum deposited (degree of vacuum:  $10^{-4}$  -  $10^{-6}$  mmHg) by an already known method.

Since it is necessary that the thickness of said deposition metal surface should retain sufficient conductivity as a current return circuit, and at the same time metal should burn out or evaporate by a small amount of current, it is preferable that the thickness of said deposition metal is set to as thin as  $0.001 - 0.6 \mu$  as described in JP32-10,438.

Now, we explain about recording sheets that use the shielding composite of the present invention as follows.

#### EMBODIMENT 1.

A dry, black layer was formed by applying approx.  $4 \text{ g/m}^2$  (solid portion) of toluene-acetone dispersion fluids to about  $60 \text{ g/m}^2$  of water-based undercoated paper, and then by drying, the fluids of which were processed by mixing 100 parts of linear

saturated copolymerized polyesters (brand name: Esteresin #2c, make of Toyobo), 10 parts of silica particles and 10 parts of carbon black, and then processed in a ball mill. White-like electric induction recording sheets were obtained by depositing aluminum approx.  $0.05 \mu$  in thickness on the surface of said layer using a vacuum deposition equipment.

When power was applied to a facsimile device having a density of scanning lines of 4 lines/mm under the condition of voltage 40V and current 10 mA using said recording sheets, clearly recorded images having a high contrast were obtained with nearly none of fumes and odors.

#### EMBODIMENT 2.

Approx.  $2 \text{ g/m}^2$  of toluen-acetone dispersion fluids, which were processed in such a way that 100 parts of linear saturated copolymerized polyesters and 20 parts of silica particles were mixed in a ball mill, were applied to the surface of approx.  $35 \text{ g/m}^2$  of paper, which was made in such a way that 50 parts of cobalt blue, 0.5 parts of melamine resin and 1 part of aluminum sulfate were added to the pulp which was pounded into viscous state, and dried to form a protection layer. As a result of vacuum deposition on the surface of said layer same as in the embodiment 1, white-like electric induction recording sheets were obtained.

While said recording sheet was used with power turned on, recording images having a high contrast were obtained without the occurrence of fumes and odors. For comparison's sake, while vacuum deposition was applied without providing said protection layer, an ash silver colored deposition surface was obtained, and thereby a good recording image could not obtained as far as when viewed with the naked eyes with power turned on for recording.

#### EMBODIMENT 3.

Approx.  $3 \text{ g/m}^2$  (solid portion) of water-based dispersion fluids, which were processed in such a way that 4 parts of polyvinyl alcohol, 40 parts of methyl methacrylate-butadiene copolymerized latex (equivalent to solid portion), 30 parts of clay, 15.6 parts of carbon black, and 1.56 parts of nonionic group surface active agents (pure portion) were mixed in a ball mill, were applied to the surface of approx.  $60 \text{ g/m}^2$  of white wood-free paper, and dried to form a black layer. Then, while a protection layer was provided on the black layer with application amount of about  $2 \text{ g/m}^2$  (solid portion) which mixture ratio was changed to 0.5 parts, 1 part, 30 parts and 40 parts of silica particles respectively for 100 parts of linear saturated polymerized polyesters,

vacuum deposition was conducted in the same way as embodiment 1, and a recorded image was obtained. As a result, an evaluation as shown in Table 2 was obtained. For comparison's sake, another evaluation was also performed for the case not provided with said transparent protection layer.

As a result, in the case of 1% through 30% by weight of the ratio of addition of silica particles to linear saturated polymerized polyester, there were superb advantages in that the color of the deposited surface was white-like color: fumes and odors scarcely occurred at the time of recording; recorded image was clear; in addition to the image easy to see with the naked eyes, particles of the black layer did not scatter at the time of recording; the sheet was strong against scratching and wear; the black layer was not exposed to the surface easily; and fingerprints did not mark so easily.

Table 2

	With protection layer				Without protection layer
Quantity of addition of silica particles to 100 parts of linear saturated polyesters	0.5 parts	1 part	30 parts	40 parts	
Color of deposited surface	Silver	White-like	White-like	Gray	Silver
Occurrence of fumes and odors at the time of recording	Nearly none	Same to the left cell	Same to the left cell	Same to the left cell	Little
Scatter of black layer particles at time of recording	None	Same to the left cell	Same to the left cell	Same to the left cell	Some
Clearness of recorded image	Unclear	Clear	Clear	Clear	Clear
Viewing of images with the naked eyes	Hard to see	Easy to see	Easy to see	Hard to see	Hard to see
Strength against scratches and wear	Strong, and black layer tends to be exposed to the surface	Same to the left cell	Same to the left cell	Same to the left cell	Weak, and black layer tends to be exposed to the surface
Marking of fingerprint	Difficult to mark	Same to the left cell	Same to the left cell	Same to the left cell	Easy to mark